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GB 2288097 A GB 2281005 A EP 0674459 A2
EP 0609654 A2

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(54) ATM network switch

(57) A method of controlling the transmission of call set-up requests by an ATM network switch, comprising:
a) sending a predetermined number of requests in a first time period;
b) monitoring the number of these requests which are successful;
c) in the next time period sending a number of requests which is a predetermined function of the number of successful requests in the preceding time period; and
d) repeating steps (b) and (c).

The invention also provides an ATM network switch comprising means for receiving call requests from end-users connected thereto, means for generating call requests to be sent to other switches connected to the said switch, means for transmitting the call requests, means for monitoring acceptance messages returned to the switch by other switches in response to the call requests and for determining therefrom the number of successful requests in a predetermined time period, and control means for sending a number of call requests during the next said period which is a predetermined function of the number of successful requests.

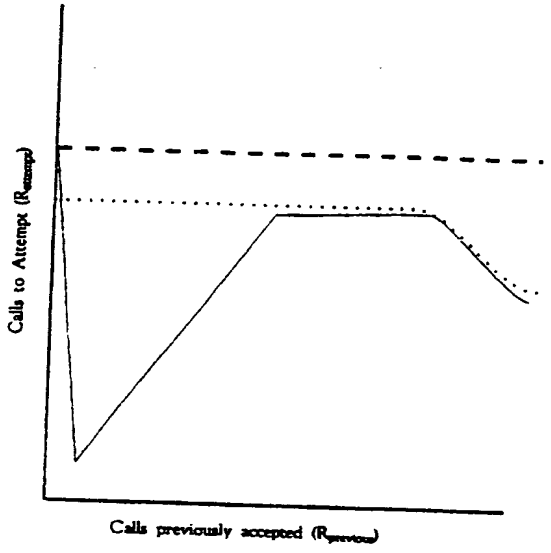

Fig 4

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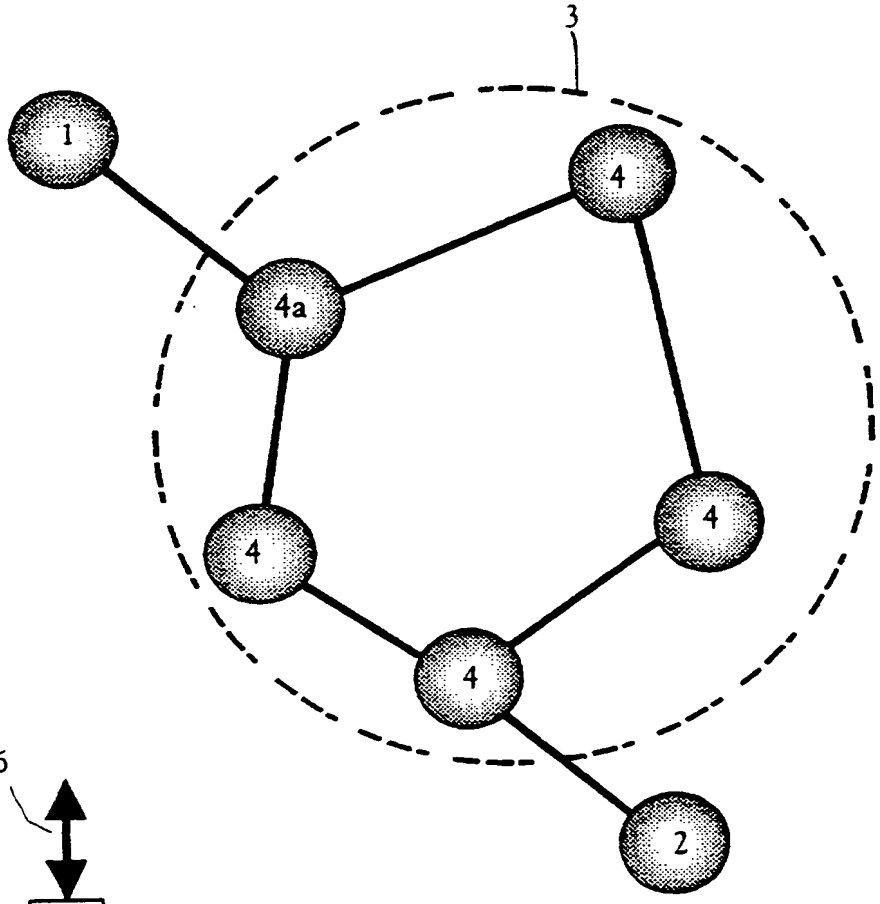
Fig 1



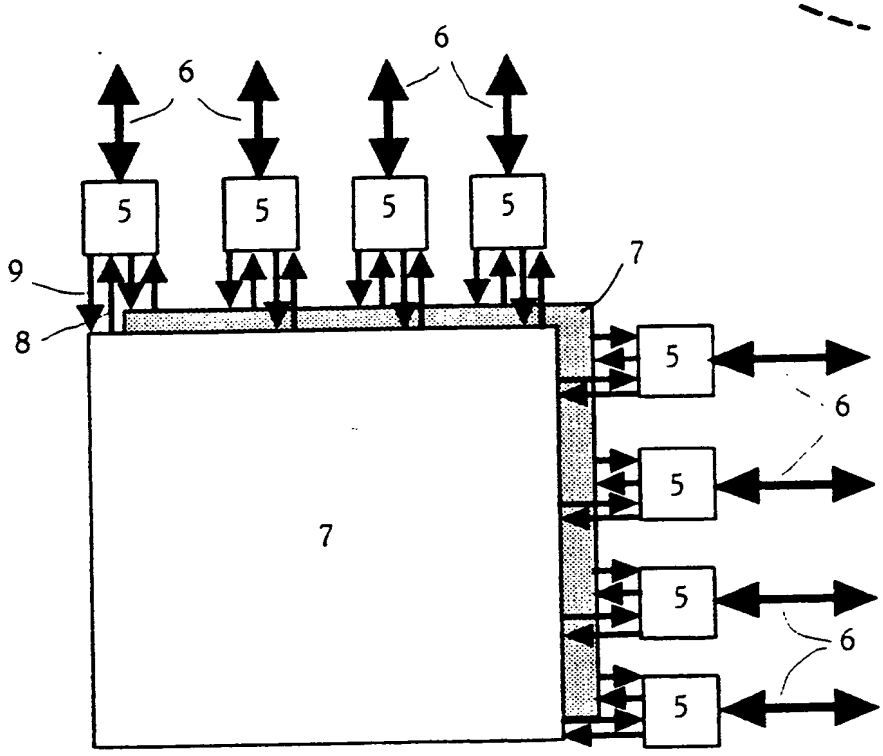


Fig 2

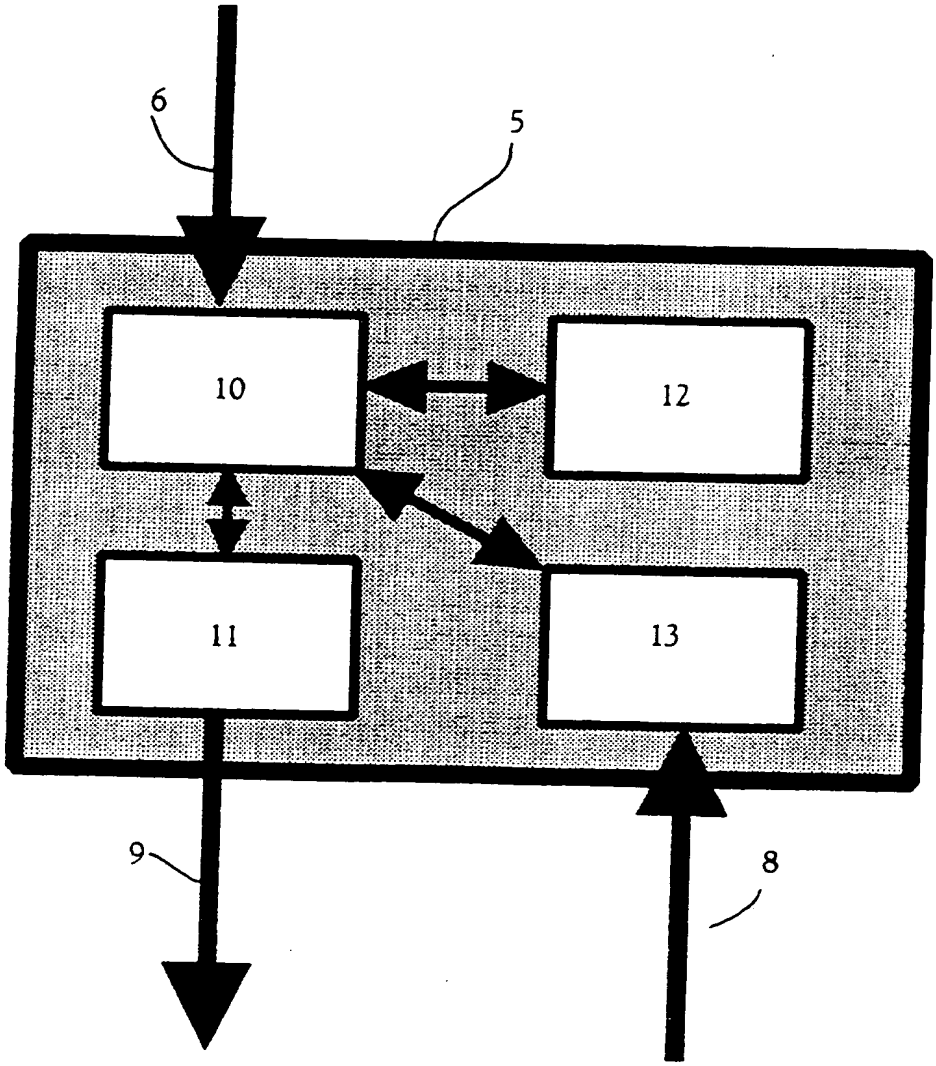


Fig 3

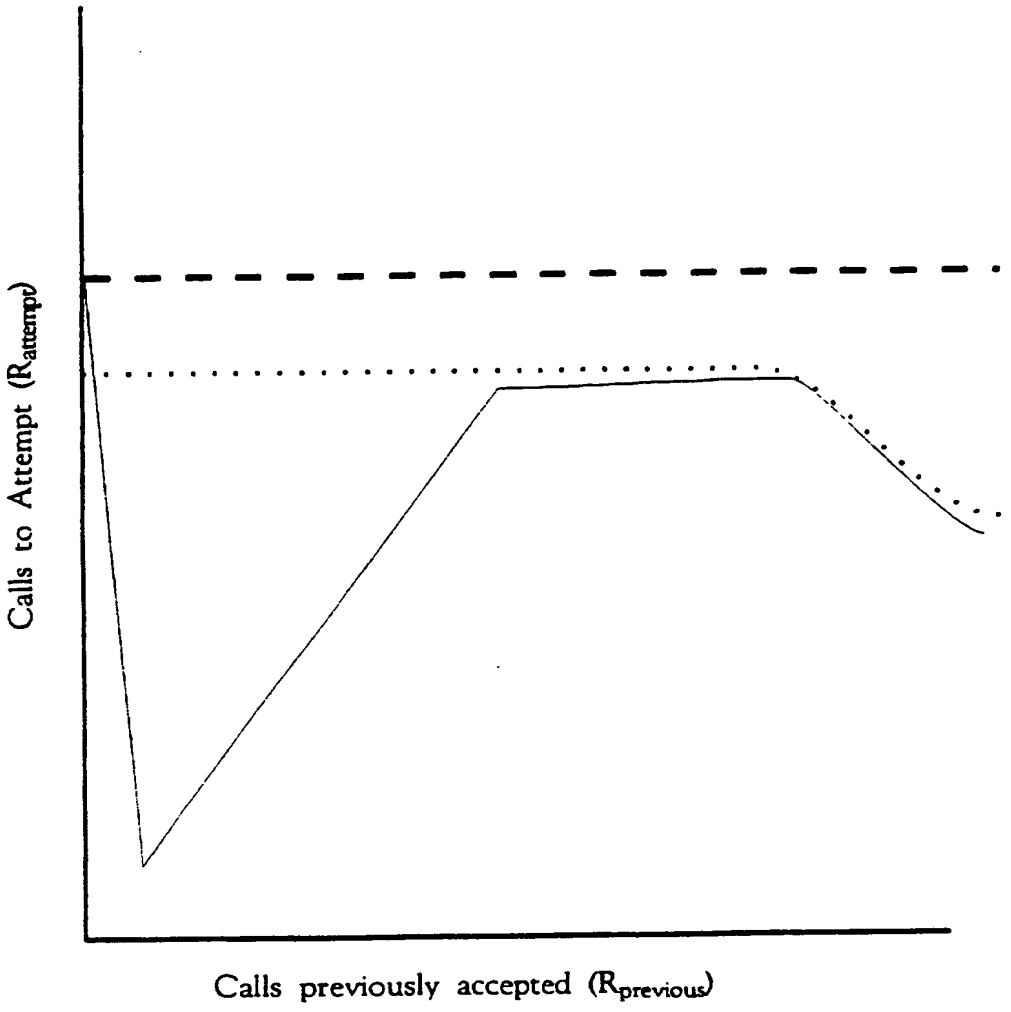

Calls to Attempt ($R_{attempt}$)
Calls previously accepted ($R_{previous}$)

Fig 4

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ATM NETWORK SWITCH

Field of the Invention

This invention relates to an asynchronous transfer mode (ATM) network switch comprising means for setting up semi-permanent virtual circuits (SPVCs), also known as "Smart PVCs".

Background to the Invention

In the setting up of a data connection in an ATM network, a virtual circuit VC is established which is the effective connection between two end-points, constituted by various components of the network, and having the effect of a hard-wired connection. The VC may be a permanent virtual circuit (PVC), in which the circuit is established by configuring manually and then remains fixed until "torn down", but it is desirable to allocate routing dynamically in order to maximise efficient usage of the network, and the object of the present invention is the implementation of semi-permanent virtual circuits, which are set up according to need and to the availability of bandwidth within the network. SPVCs are set up by specifying the connection at each end point. The master end generates the set-up or call request and sends this through the network, setting up the path step-by-step. The number of such call requests could readily reach a level such that the switch and/or the attached network cannot process all the SPVCs configured by the network operator. For example, a slot controller within a network switch might be able to handle 10 call requests per second, whereas the operator might configure 100 SPVCs, each with a retry time of 1 second, where the retry time is the predetermined delay between the failure of one call request and the issuing of another. It will be apparent that not all 100 calls can be established in a single second.

In a large multi-switch real network, the calls per second that can be supported will vary depending on the destination and loading of the route, making the control of SPVCs even more difficult.

Summary of the Invention

According to the present invention, a method of controlling the transmission of call set-up requests by an ATM network switch, comprises:

a) sending a predetermined number of requests in a first time period;

b) monitoring the number of these requests which are successful;

c) in the next time period sending a number of requests which is a predetermined function of the number of successful requests in the preceding time period; and

d) repeating steps (b) and (c).

The predetermined time period may, for example, be one second. Preferably, step (c) comprises sending a number of requests which is the smaller of (a) the maximum number of calls supportable by the cell in said next time period and (b) the sum of the number of successful requests in the preceding time period and a predetermined increment. The increment may simply be one, or it may be a predetermined fraction of the previous number of successful attempts, for example of the order of 10%.

In an another method in accordance with the invention, the number of requests sent in the first time period is a fraction, for example approximately half, of the maximum number of requests supported by the switch in said period. The number of requests in the second period from start-up may then be, for example, double that of the first period.

Alternatively, the method comprises establishing in memory means in the switch a look-up table representing the relationship between the number of

successful requests in the preceding period and the number of requests to be sent in the present period, and step (c) comprises using the number determined in step (b) to determine from the look-up table the number to be sent in the next time period.

The method preferably includes determining for each individual request whether a predetermined retry period for that request has expired since the request was last sent, and only sending the request again if the retry period has expired.

In a preferred embodiment, the number of requests controlled is the number sent on any individual external data link to the switch. Alternatively, the number of requests per address domain may be controlled in accordance with the invention.

The invention also provides an ATM network switch comprising means for receiving call requests from end-users connected thereto, means for generating call requests to be sent to other switches connected to the said switch, means for transmitting the call requests, means for monitoring acceptance messages returned to the switch by other switches in response to the call requests and for determining therefrom the number of successful requests in a predetermined time period, and control means for sending a number of call requests during the next said period which is a predetermined function of the number of successful requests.

Preferably, the switch comprises memory means for storing a look-up table representing the relationship between the number of successful requests in the preceding period and the number of requests to be sent in the present period, and wherein the control means is arranged to determine from the look-up table for each number of successful requests measured the number of requests to be sent in the next time period.

Brief Description of the Drawings

In the drawings, which illustrate diagrammatically an exemplary embodiment of the invention:

Figure 1 is a representation of a simple ATM network;

Figure 2 is a representation of an ATM network switch forming part of the network;

Figure 3 is a representation of a portion of a slot controller of the edge switch in the network of Figure 1; and

Figure 4 is a graph of the function representing the relationship between the number of successful requests in one time period and the number of requests to be sent in the next time period.

Detailed Description of the Illustrated Embodiment

Referring to Figure 1, the network comprises a source 1 seeking to send data to a destination 2 via a public network 3 which has unpredictable SVC establishment delays. The network consists of a plurality of ATM network switches 4, of which the first to which the source is directly connected is referred to as the "edge switch" 4a. It is in this edge switch, which can, of course, be any switch in the network to which a source connection is made, in which the method of the invention is carried out. The edge switch 4a sends out call requests through the network 3 to establish a connection to the destination 2.

Figure 2 illustrates diagrammatically one of the ATM network switches 3. The switch consists of a plurality of slot controllers 5; in the simple arrangement illustrated eight slot controllers are shown, but a typical switch might have 16 slot controllers. Each slot controller 5 has external input/output links 6. The switch has a pair of switch fabrics 7 of a dynamic crosspoint type and each having input and output connections 8 and 9 respectively to each of the slot controllers 5. The

two switch fabrics may be operated in such a manner as to double the bandwidth of the switch or to provide an immediate alternative path should any particular path through one switch fabric fail. This type of arrangement is described in more detail in our earlier application GB9507454.8. The structure of the slot controllers is, for example, of the general type described and claimed in our earlier application GB9505358.3, and ATM cells arriving on an input link 6 may be processed in the general manner described in that application. It will be appreciated that reference to these particular types of switch as disclosed and claimed in our earlier patent applications is by way of example only, and is not intended to be limiting; other types of switch may employ the method of the invention.

Referring now to Figure 3, the slot controller 5 is illustrated schematically and the Figure includes only those components which are directly relevant to the invention; it will be appreciated that components performing other functions will be present in the working switch. The external data link 6 is connected to a receiver 10 which *inter alia* receives from the source 1 (Figure 1) an initial call request. As a result the receiver 10 generates a call request to send on to the next switch via the transmitter 11 and the switch fabric in the manner set out in our earlier applications, hereinbefore identified. A memory means 12, in the form of a region of the random access memory (RAM) in the slot controller, is configured to store a look-up table type of database which includes for each number of successful requests in a given time period the number of requests to be attempted in the next time period. Successful requests result in the receipt of acknowledgement signals at an input receiver 13 connected to the input connection 8 from the switch fabric to the slot controller 5. The successful requests are signalled back by the input receiver 13 to the receiver 10, which counts the number for a given time period, for

example a second, and then refers to the look-up table in the RAM 12 to determine the number to be attempted in the next time period.

Figure 4 is a graph illustrating a typical function of successful requests to next attempted requests. The function of the number of calls to attempt in the next time period ($R_{attempt}$) against calls accepted in the previous time period ($R_{previous}$) is represented by the solid curve, while the upper broken line represents the maximum number of calls per time period supported by the switch. The dotted line represents the maximum number of calls per time period that the network can accept. This can vary with time. The function can be stored as the look-up table in the RAM 12 referred to hereinbefore.

CLAIMS

1. A method of controlling the transmission of call set-up requests by an ATM network switch, comprising:

a) sending a predetermined number of requests in a first time period;

b) monitoring the number of these requests which are successful;

c) in the next time period sending a number of requests which is a predetermined function of the number of successful requests in the preceding time period; and

d) repeating steps (b) and (c).

2. A method according to Claim 1, wherein step (c) comprises sending a number of requests which is the smaller of (a) the maximum number of calls supportable by the cell in said next time period and (b) the sum of the number of successful requests in the preceding time period and a predetermined increment.

3. A method according to Claim 2, wherein the increment is a fraction of the maximum number of calls supportable by the switch in said period.

4. A method according to Claim 3, wherein the fraction is about 1/10.

5. A method according to Claim 1, wherein the number of requests sent in the first time period is a fraction of the maximum number of requests supportable by the switch in said period.

6. A method according to Claim 5, wherein the fraction is approximately a half.

7. A method according to Claim 6, wherein the number of requests sent in the second period is double that of the first period.

8. A method according to Claim 1, which comprises establishing in memory means in the switch a look-up table representing the relationship between the number of successful requests in the preceding period and the number of

requests to be sent in the present period, and step (c) comprises using the number determined in step (b) to determine from the look-up table the number to be sent in the next time period.

9. A method according to any preceding claim, comprising determining for each individual request whether a predetermined retry period for that request has expired since the request was last sent, and only sending the request again if the retry period has expired.

10. A method according to any preceding claim, wherein the number of requests controlled is the number sent on any individual external data link to the switch.

11. A method of controlling the transmission of call set-up request in an ATM network switch, substantially as described.

12. An ATM network switch comprising means for receiving call requests from end-users connected thereto, means for generating call requests to be sent to other switches connected to the said switch, means for transmitting the call requests, means for monitoring acceptance messages returned to the switch by other switches in response to the call requests and for determining therefrom the number of successful requests in a predetermined time period, and control means for sending a number of call requests during the next said period which is a predetermined function of the number of successful requests.

13. An ATM network switch according to Claim 11, comprising memory means for storing a look-up table representing the relationship between the number of successful requests in the preceding period and the number of requests to be sent in the present period, and wherein the control means is arranged to determine from the look-up table for each number of successful requests measured the number of requests to be sent in the next time period.

14. An ATM network switch, substantially as described with reference to the drawings.

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Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search report)

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Relevant Technical Fields

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(ii) Int Cl (Ed.6) H04Q

Search Examiner
AL STRAYTON

Date of completion of Search
17 JANUARY 1996

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE: WPI

Documents considered relevant following a search in respect of Claims :-
ALL

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2288097 A (ROKE MANOR)	
A	GB 2281005 A (GPT)	
A	EP 0674459 A2 (ATT)	
A	EP 0609654 A2 (NEC)	

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